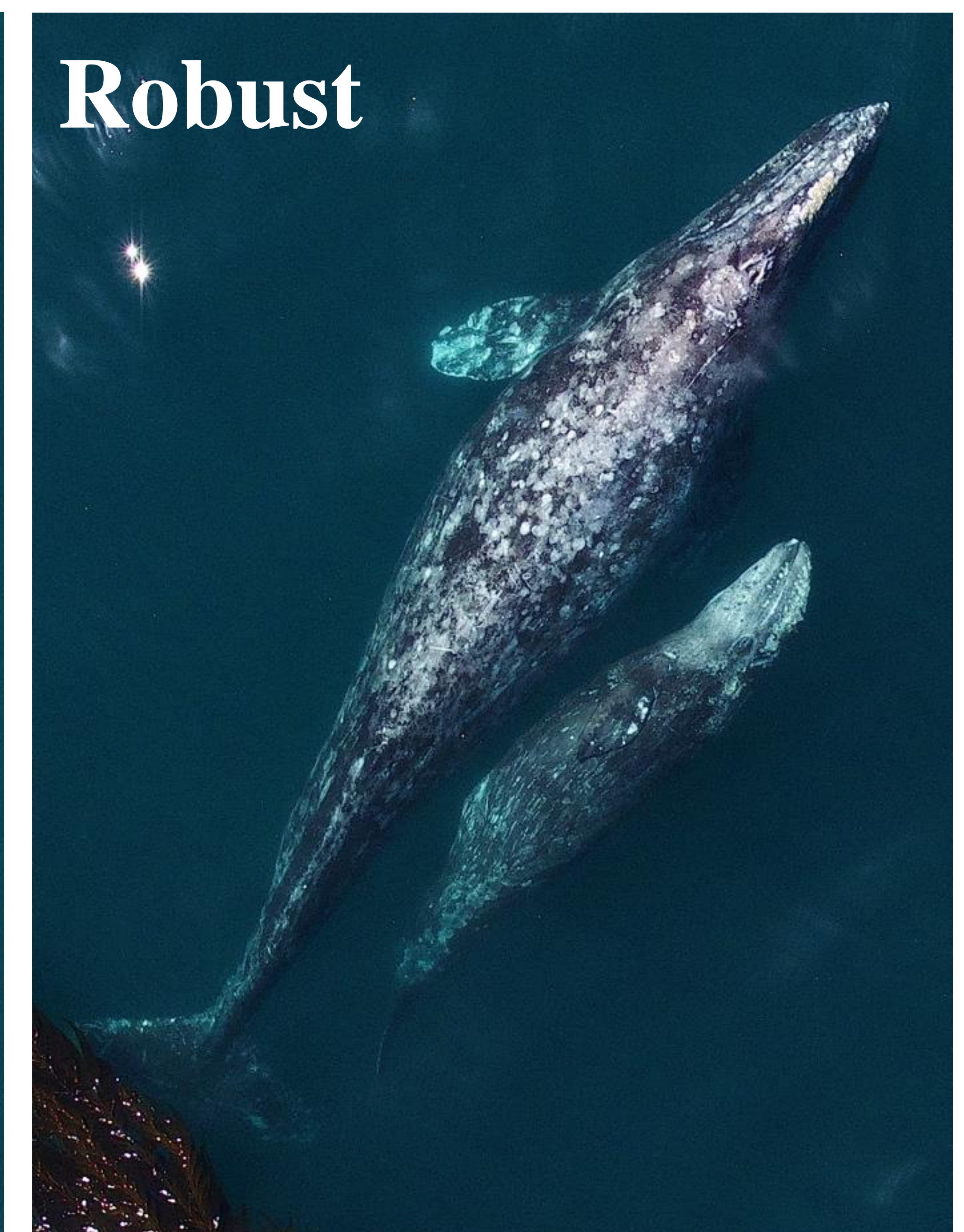
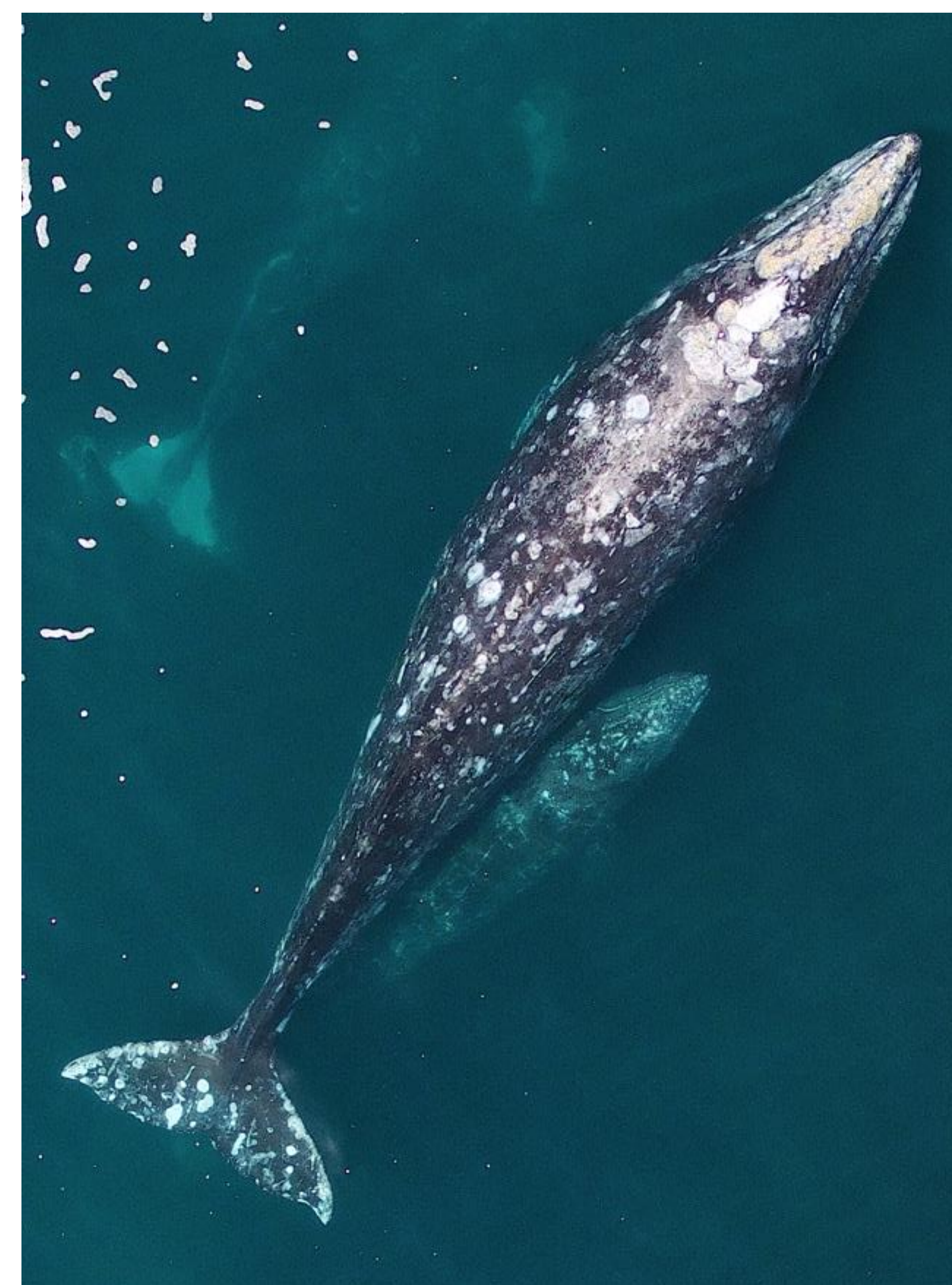
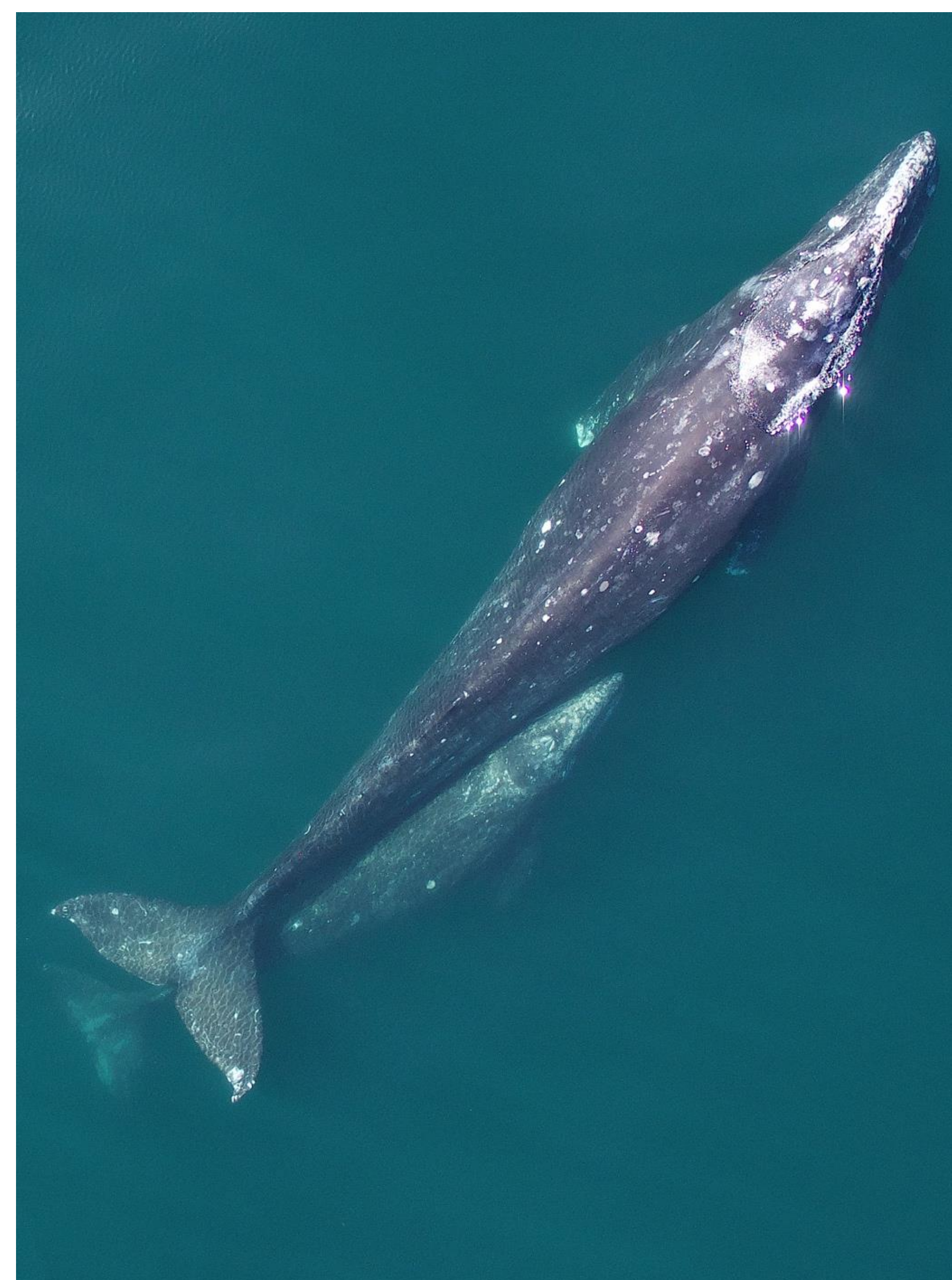


Shore-based UAS photogrammetry of gray whales

Gray whales migrate up the west coast of North America each spring, heading for arctic feeding grounds. To understand patterns of reproductive success, we are using vertical photographs from a remotely controlled hexacopter (APH-22, Aerial Imaging Solutions) to measure calf growth and female condition.



Hexacopter flights from shore In 2015 and 2016 we flew 190 flights up to 450 m (1510 ft) offshore from Piedras Blancas, California. Flights averaged 10 minutes (max = 19) and photographs of whales were obtained from typical altitudes of 40-55 m with a 16MP Olympus E-PM2 camera and 25 mm lens.



Width profiles to assess condition Images were obtained from 130 female-calf pairs. Altitude measured using an onboard pressure sensor enabled estimates of lengths ranging from calves <7 m to adults >15 m. Width profiles demonstrated our ability to detect whales in varying condition, ranging from lean to robust. Vertical images will now be used to monitor changes over years.



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